7. --~~15~~. (New) An air bag as defined by claim 9 or 10, wherein the yarns forming the woven fabric have a fineness in the range of 66 to 167 decitex, a tensile strength in the range of 4.85 to 7.5 cN/decitex, and a tensile work at break in the range of 1.32 to 2.65 cN•cm/decitex.--

8. --~~16~~. (New) An air bag as defined by claim 9 or 10, wherein the air bag is selected from those for a driver's seat, for a passenger's seat and for side impact protection.--

Sub B1 Cont'd

REMARKS

Claims 1-8 have been canceled and replaced by claims 9-16. Claims 9-16 are now in the case.

Applicants appreciate the Examiner's identification of the informalities in the original claims. These claims have been canceled. In the replacement claims 9-16, these informalities have been corrected, and several other changes have been made to improve grammar and syntax. Additionally, independent claims 9 and 10 include structure found in part in claim 7, namely, that the polyamide fiber yarns contain a plurality of single filaments, each filament having a fineness in the range of 1.0 to 3.3 decitex.

Claims 1-8 were rejected under 35 U.S.C. § 103(a) as unpatentable over the patent to Mizuki et al. in view of the patent to Khandhadia et al. This rejection is respectfully traversed and will be addressed with reference to claims 9-16.

The main object of the present invention is to reduce drastically the weight and volume (thickness of woven fabric) of an air bag while maintaining the mechanical properties of the air bag such as durability against long-term aging. (spec. p. 3, l. 24-29;

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p. 4, l. 15 -20) The compactly stowable (compactly folded and stowed in an air-bag case), lightweight, and soft, pliable air bag of the present invention is basically formed of a base fabric composed of a polyamide fiber yarn in which a copper compound is incorporated. The yarn consists of a plurality of filaments, each single filament having a fineness in a range from 1.0 to 3.3 decitex. The fabric is structured to have the product of the fineness of warp (or weft) yarn of the fabric multiplied by weave density (warp or weft) (referred to as "weave fineness" on p. 9, l. 20-21) not more than 16000 decitex•end (or decitex•pick; in case of weft yarn), and the fabric is to exhibit a load at 15% tensile elongation in a range of 3 to 35 N/%/2.54 and a tensile work at break in a range from 7000 to 30000 N•%/2.54 cm.

The specific value range of tensile work at break of the fabric forming the present air bag determines the durability which will withstand the kinetic energy of the air bag when projected forward to a maximum extent. Because the tensile work at break of the woven fabric forming the air bag is more decisive than the tensile strength at break of the fabric (spec. p. 8, l. 13-33), the tensile work value of the fabric is more significant because use of a lightweight and thinner base fabric is required for obtaining a lightweight and compactly stowable air bag. The value range of the load at 15% elongation of the fabric is determined in order to obtain a pliable air bag that prevents occurrence of injury of the vehicle occupant at impact (spec. p. 9, l. 24-32).

These mechanical properties are maintained even after the air bag has been exposed to prolonged periods of heat aging, wet heat-aging and ozone-aging (spec. p. 9, l. 33 - p. 10, l. 6).

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Examples 1 to 6 of the present invention, where the fabric is composed of yarn consisting of a plurality of filaments each filament having a fineness in a range from 1 to 3.3 decitex, provide a fabric satisfying the above features and have a thickness as thin as 0.198 mm or smaller and having a basis of weight of 125 g/m^2 or less (spec. p. 19, Table 1). The fabrics of the Examples exhibit a strength retention to heat of 95%. The air bag obtained from each of the fabrics is light in weight and compactly foldable and did not break at deployment test. In contrast, the thickness of the woven fabric for the air bag of Comparative Example 4 (spec. p. 20, Table 2), where the fabric has a weave fineness of 18174 decitex end/2.54 cm, is 0.230 mm which is greater than the thickness of the present Examples. As a result, the air bag obtained from this comparative fabric is heavier in weight and less compactly folded although the air bag was not broken at deployment test.

The fabric of Comparative Example 3 (Table 2) is formed of yarn (56 decitex/34 filaments) consisting of a plurality of single filaments each having a fineness of about 1.6, has a tensile work at break of 6000 N%/2.54 cm (5900 N%/2.54 cm) which is out of the scope of the invention because the relative viscosity of the polyamide yarn was too low to obtain a yarn having a high tensile work at break. The air bag formed of this fabric was broken at the deployment test.

The aforedescribed parameters and features of the present invention where found in claims 9-16 are simply not taught or made obvious by Mizuki et al., alone or in combination with Khandhadia et al. The Examiner has acknowledged the shortcomings of Mizuki et al. by listing nine elements found in the claims but missing from Mizuki et al.

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1300 I Street, NW
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These shortcomings include, with reference to claims 9 and 10, the following features (a)-(d):

(a) the woven fabric composed of polyamide fiber yarn containing a copper compound having a copper concentration of 30 - 200 ppm;

(b) the woven fabric formed of yarn consisting of a plurality of single filaments, each single filament having a fineness in a range of 1.0 - 3.3 decitex;

(c) the fabric wherein the product of fineness of warp or weft of the fabric multiplied by the weave density of the fabric is not more than or is less than 16,000 decitex•end or pick, respectively /2.54 cm;

(d) the fabric having a load at 15% tensile elongation in a range of 3 - 35 N/%/2.54 cm, and a tensile work at break in a range of 7000 - 30000 N•%/2.54 cm.

The reason that these shortcomings exist in Mizuki et al. is that this patent is directed to an air-bag construction in many ways remote from the airbag construction of present claims 9-16 as taught in the subject specification. First, in regard to feature (a), Mizuki et al. just plain fails to disclose or suggest a woven fabric composed of polyamide fiber yarn containing a copper compound having a copper concentration of 30 - 200 ppm. (As discussed later, Khandhadia et al. does not fill this void.)

Contrary to feature (b) of claims 9 and 10, Mizuki et al. proposes a high-strength, ultra-fine fiber construction (woven fabric of an air bag, for example) which comprises high-strength polyamide multi-filament yarn including ultra-fine filaments with a fineness of a single filament of 0.1 denier or more and less than 0.8 denier. See, for example, col. 28, Table 1-continued <Properties of Yarn After Removal or Division>; Col. 22, Comparative Example 1; and col. 27, l. 56 - col. 28, l. 59. Mizuki et al. suggest that the

FINNEGAN
HENDERSON
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1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
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single filament denier (0.89 denier = 0.99 decitex) is still excessively large, resulting in a reduction in softness. Therefore, the high-strength, ultra-fine fiber construction of Mizuki et al. does not begin to contemplate the present woven fabric having the feature (b) of the claims 9 and 10.

Regarding feature (c), Mizuki et al. state that a base fabric for an air bag is to have a cover factor K of 1,900 or more, more preferably 2,000 or more in order to make it possible to obtain a desired characteristic of the base fabric for the air bag even when uncoated.

Table A attached herewith is a comparison table showing the cover factors K ($\sqrt{denier \bullet ends / inch} + \sqrt{denier \bullet picks / inch}$; col. 18, l. 1-9 of Mizuki et al.) and the weave fineness (decitex•end(pick)/2.54 cm according to the present invention) for the fabrics of Examples and Comparatives of Mizuki et al. and the fabrics of the preset Examples and Comparative Examples. From Table A, it is apparent that the fabrics of Examples of the present invention differ significantly in the value (16000 or less) of weave fineness from that (18007 or greater) of the fabrics of Examples of Mizuki et al. Therefore, feature (c) of the present claim 1 is not and could not be disclosed in Mizuki et al. Because the weave fineness of fabric is related to the basis of weight of a fabric and proportional to basis of weight per area of fabric, the air bag of the present invention is significantly lighter in weight than the air bag formed of the fabric of Mizuki et al.

In regard to feature (d), Mizuki et al. do not recognize the significance of the specific value range of tensile work at break of the fabric forming the present air bag. The tensile work at break of the woven fabric forming the air bag is a more decisive factor than the tensile strength at break of the fabric. The present tensile work value

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202.408.4000
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range of the lightweight and thin fabric formed of the yarn consisting of single filaments each having a fineness in a range from 1 to 3.3 decitex cannot be obvious from the Mizuki et al. air-bag disclosure because the fabric of Mizuki et al. is formed of yarn consisting of filaments having a fineness of 0.1 denier (=0.11 decitex) or more or less than 0.8 denier (=0.88 decitex) which is completely different in yarn-forming fabric construction. Further, it would not be predictable from Mizuki et al. that the tensile work value of the present base fabric is maintained even after the air bag is exposed to prolonged periods of heat aging, wet heat-aging and ozone-aging. Thus, as shown, Mizuki et al. fails to show or suggest any of the claimed features (a), (b), (c), and (d) and thus fails as a primary reference in the obviousness rejection advanced by the Examiner.

The Examiner attempts to meet feature (a) of claims 9 and 10 by incorporating the Khandhadia et al. patent, but the latter patent misses the mark. Khandhadia et al. disclose an air bag in which the inner surface of the fabric bag body is provided with a coating layer including copper oxide and HOPCALITE (mixture of oxides of copper, cobalt, manganese and silver) for the purpose of reducing the carbon monoxide and nitrous oxide derived from non-azide based gas generants used in the inflator. The coating layer of copper oxide in the form of particles should be disposed on the inside surface of the fabric forming the air bag, because the carbon monoxide contained in the effluent must be intoxicated within a few seconds upon introduction of the inflating gas into the air bag. Accordingly, Khandhadia et al. do not teach or suggest that the copper oxide can be incorporated into the fiber forming the air bag because the effluent gas could not readily access the copper oxide embedded or mixed in the fiber, and the

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1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
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purpose of Khandhadia et al. in this regard would be destroyed. Thus this patent is irrelevant to enhancement of resistant to aging under heat and air of polyamide fiber fabric forming an air bag by the incorporation of a defined amount of a copper compound into polyamide fiber. It therefore would not be obvious for one of ordinary skill in the art at the time of the applicants' invention to conceive feature (a) of the present invention based on the concept taught by Khandhadia et al., and the rejection of the claims based on the proposed combination of the two references must fail for this reason also.

The Examiner attempts to minimize the inventive contribution of applicants by stating that everything not disclosed by Mizuki et al. "would be readily determined through routine experimentation". To begin with, such statement ignores the distinctive claimed features described above. Secondly, the total fineness, weave density, drawing ratio (birefringence) disclosed in Mizuki et al. are all subsidiary factors of the present invention, and these factors per se cannot and do not teach the significance of the respective concepts of features (a), (b), (c), and (d) of the present invention set forth above and claimed in claims 9 and 10.

Thirdly, In re Boesch and Slaney cited by the Examiner has been reviewed, but this case does not support the proposition asserted. There is no seeking here as in Boesch and Slaney of the optimum value of a result effective variable in a known process. Applicants are not attempting to optimize the teachings of Mizuki et al. through experimentation. The air bag of the present invention as shown above differs significantly and conceptually from the air bag of Mizuki et al. The Examiner has failed

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1300 I Street, NW
Washington, DC 20005
202.408.4000
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to show in a convincing manner that someone skilled-in-the-art would be led by experimentation from Mizuki et al. to the claimed invention.

The dependent claims 11-16 also distinguish over the cited art for the reasons set forth above as well as for any recitations of novel and unobvious structure.

The Examiner refers to col. 12, l. 12-21 of Mizuki et al. which reads: "The conjugate yarn thus obtained by subjecting to the drawing process has a single filament denier of 3(d) or more and preferably of 5(d) or more. When the single filament denier is less than 3(d), unevenness in the fineness is generated due to the sway of the yarns in the heating tube during the spinning. . . ." This passage refers to the denier of an islands-in-sea-type conjugate single filament forming the conjugate yarn to be fabricated into a precursor fabric from which the final fabric composed of the yarn is made and which consists of a plurality of single filaments each having a fineness of 0.8 denier or less (see col. 4, l. 42-56). Therefore, the referenced description is irrelevant to the yarn used for weaving the fabric forming the air bag of the present claims.

Early reexamination and allowance of claims 9-16 are earnestly solicited.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: March 26, 2002

By: Tipton D. Jennings
Tipton D. Jennings
Reg. No. 20,645

FINNEGAN
HENDERSON
FARABOW
GARRETT &
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
www.finnegan.com

APPENDIX TO AMENDMENT OF MARCH 25, 2002

VERSION WITH MARKINGS TO SHOW CHANGES MADE

AMENDMENTS TO THE SPECIFICATION

Replace the paragraph bridging lines 18-33 of page 6 with the following new paragraph:

--The air bag according to the present invention is excellent in weight reduction and pliability so that a favorable compactness is obtainable if the fabric is composed of yarns (warp and weft), each consisting of a plurality of filaments having a total fineness in a range from 66 to 167 decitex and a single filament fineness in a range from 1.0 to 3.3 decitex, and has the above-identified tensile work at break. Also, a resistance to heat-aging, a resistance to wet heat-aging and a resistance to ozone of the air bag could be improved to a large extent if a woven fabric composed of polyamide fiber yarns containing a predetermined amount of [metallic copper,] copper salt (copper acetate, halogenated copper, copper bromide or others), halogenated alkaline metals or mixtures of various copper salts and organic bases is used.--

Replace the paragraph bridging lines 10-19 of page 11 with the following new paragraph:

--In the present invention, woven fabrics composed of yarns containing [metallic copper,] copper salt (copper acetate, halogenated copper, copper bromide or others),

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HENDERSON
FARABOW
GARRETT&
DUNNER LLP

1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
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halogenated alkaline metals or mixtures of various copper salts and organic bases as the stabilizing agents for improving the heat durability are used. These copper compounds may be added to polyamide fibers in a known manner, such as added in a polymerization process of polyamide or incorporated into polymer chips.--

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1300 I Street, NW
Washington, DC 20005
202.408.4000
Fax 202.408.4400
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Table A

	USP 5637385 Mizuki et al.**								Present invention*						
	Weaving yarn fineness in denier		Weave density end (or picks)/inch (= 2.54 cm)		Cover factor K	Weave fineness*** decitex·end/decitex/inch (= 2.54 cm)			Weaving yarn fineness in decitex		Weave density end (or picks)/2.54 cm		Cover factor K	Weave fineness*** decitex·end/ 2.54 cm	
	Yarn	Single filament	warp	weft		warp	weft		Yarn	Single filament	warp	weft		warp	weft
EX1	310	0.32	63	61	2,183	21,700	21,011	EX1	156	2.22	95	93	2,228	14,820	14,508
EX2	222	0.23	72	72	2,160	18,007	17,760	EX2	156	2.22	95	93	2,228	14,820	14,508
EX3	774	0.72	30	29	1,641	25,800	24,940	EX3	156	2.22	95	93	2,228	14,820	14,508
EX4	330	0.34	62	61	2,234	22,733	22,367	EX4	156	2.22	90	98	2,228	14,040	15,288
EX5	323	0.29	62	61	2,211	22,251	21,892	EX5	156	2.22	94	94	2,228	14,664	14,664
EX6	258	0.50	74	72	2,345	21,213	20,640	EX6	78	2.22	142	142	2,380	11,076	11,076
CE1	320	0.89	58	57	2,357	20,622	20,267	CE1	156	2.22	95	93	2,228	14,820	14,508
CE2	222	0.28	73	73	2,175	18,007	18,007	CE2	156	2.22	95	93	2,228	14,820	14,508
CE3	774	0.28	53	53	1,579	13,073	13,073	CE3	56	2.22	192	190	2,712	10,752	10,640
CE4								CE4	233	6.66	75	75	2,216	18,174	17,475
CE6	310	0.32	63	61	2,183	21,700	21,011								

* See Table 1 (page 19) and Table 2 (page 20)/EX Example; CE Comparative Example

** See Table I continued (column 28) and Table II (columns 27 and 28)-EX4 is on polyamide filament yarn.

*** The product of a total fineness of warp (or weft) multiplied by a weave density (see page 9 lines 16 - 21 of the present specification)